PTO 06-2450

CY=JA DATE=19870203 KIND=A
PN=62-025884

EMERGENCY DYNAMIC BRAKING SYSTEM OF SERVOMOTOR
[Sabo mota no hijojihatsuden seigyo hoshiki]

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UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. February 2006

Translated by: FLS, Inc.

PUBLICATION COUNTRY	(19):	JP
DOCUMENT KIND	(12):	A
	(13):	PUBLISHED UNEXAMINED PATENT APPLICATION (Kokai)
PUBLICATION DATE	(43):	19870203 [WITHOUT GRANT]
PUBLICATION DATE	(45):	19870203 [WITH GRANT]
APPLICATION NUMBER	(21):	60-164512
APPLICATION DATE	(22):	19850724
PRIORITY DATE	(32):	
ADDITION TO	(61):	
INTERNATIONAL CLASSIFICATION	(51):	H02P 3/18
DOMESTIC CLASSIFICATION	(52):	
PRIORITY COUNTRY	(33):	
PRIORITY NUMBER	(31):	
PRIORITY DATE	(32):	
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TITLE	(54):	EMERGENCY DYNAMIC BRAKING SYSTEM OF SERVOMOTOR
FOREIGN TITLE	[54A]:	Sabo mota no hijojihatsuden seigyo hoshiki

Specification

1. Name of this Invention

Emergency Dynamic Braking System Of Servomotor

2. Claims

[1] Emergency dynamic braking system of servomotor comprising a converter for converting an AC current to a DC current, an inverter for converting the DC voltage obtained from the converter into an AC voltage, and a discharger for absorbing the regenerative power from a loaded servomotor, wherein said discharger for absorbing the regenerative power is used for controlling the system at the time of servomotor in abnormal state.

3. Detailed Explanation of this Invention

[Industrial Field]

This invention pertains to an emergency dynamic braking system of servomotor.

[Prior Art and its Problems]

Figure 2 is a circuitry schematic of a conventional control device used for operating a servomotor.

The commercial power source is rectified by a 3-phase rectifying circuit **2** through a main switch **1** for turning on or off the power source and charged to a condenser through an auxiliary switch **3**. A resistor **5** connected parallel to the auxiliary switch **3** is provided for protecting the rectifying element of the rectifying circuit **2** from the rushed charge current of the condenser **4** when the auxiliary

switch **3** is turned on. Thus, after the condenser **4** is charged through the resistor **5** for a fixed duration, the auxiliary switch **3** is turned on. The DC voltage (termed middle voltage) charged to the condenser **4** is inputted to the inverter circuit **6** having transistors T_1 - T_6. By switching the above-mentioned transistors T_1 - T_6 using the circuit (not shown) by operating the transistors T_1 - T_6, an AC voltage is obtained from the inverter circuit **6** and supplied to the loaded servomotor **7**. Item 8 denotes a discharging resistor provided for protecting the circuit element such as inverter circuit **6** from excessive voltage when the middle voltage becomes high due to the regeneration control for loaded servomotor **7**, etc. This discharging resistor **8** is connected parallel to the condenser **4** through the switching transistor **9**. Item 10 denotes a discharge control circuit for controlling the transistor **9**, which transmits a signal for turning on the switching transistor **9** when the detected middle voltage exceeds a threshold value. Item 11 denotes a resistor for controlling the charge at the time of servomotor emergency, which is connected parallel to the condenser **4** through the switch **12** which is turned on at the time of emergency. Diodes D_1 - D_6 connected parallel to respective transistors T_1 - T_6 are for protecting the transistors T_1 - T_6 at the time of switching.

The above-mentioned circuit configuration requires a discharge circuit consisting of a resistor **8** and transistor **9** for suppressing an excessive voltage during the normal operation and a control

circuit consisting of a resistor **11** and switch **12** for controlling the charging process during emergency. Moreover, resistors and switches used with these circuits must have a large transmission capacity, thereby preventing the production of compact control circuit.

[Purpose of this invention]

This invention was developed to solve the above-mentioned problems. The object of this invention is to provide an emergency dynamic braking system of servomotor which can be manufactured as a smaller device at a less cost by adding a load emergency control function to the discharge circuit for suppressing an excessive voltage.

[Constitution of this Invention]

The emergency dynamic braking system of servomotor of this invention comprises a converter for converting an AC current to a DC current, an inverter for converting the DC voltage obtained from the converter into an AC voltage, and a discharger for absorbing the regenerative power from a loaded servomotor, wherein said discharger for absorbing the regenerative power is used for controlling the system at the time of servomotor in abnormal state.

[Operational Example]

Figure 1 is a circuitry schematic of control device used in the first operational example of this invention. In the figure, the parts equivalent to those shown in Fig. 2 are denoted by the same symbols. In this circuitry, a resistor **13** serially connected between

the base of the switching transistor **9** to which a control signal is inputted from the discharge control circuit **10** and the + pole of condenser **4** and a connection point **14** operated synchronous to the main switch **1** are inserted. Also, the resistor **11** and switch **12** for controlling the charging at the time of emergency, used in the circuit shown in Fig. 2, are eliminated. The protection circuit **20** drives each transistor T_1 - T_6 of the inverter circuit **6**, and when an excessive current of the servomotor **7** is detected by the excessive current detector **21**, the protection circuit **20** shuts each transistor T_1 - T_6 off and releases the main switch **1**.

Hereafter, the operation of control device based on the above-mentioned circuit configuration is explained.

The main switch **1** is turned on, and then, the auxiliary switch **3** is turned on after a certain duration. When the operation is controlled by the inverter circuit **6**, the contact point **14** is operated at the same time when the main switch **1** is turned on, being set as open contact. Therefore, as described with the conventional example shown in Fig. 2, when the middle voltage **E** in the condenser **4** elevates due to the regenerative control for the servomotor **7** and the like, this voltage increase is detected by the discharge control circuit **10** which then sends a signal for turning on the switching transistor **9**. Thus, the excessive voltage charged to the condenser **4** is discharged through the resistor **8** and switching transistor **9** and lowers. Once this middle voltage **E** is lowered to a threshold value,

the discharge control circuit **10** detects the lowered voltage **E**, allowing the ON signal having been transmitted from this discharge control circuit **10** to be shut off, setting the switching transistor **9** to off, subsequently stopping the above-mentioned discharge. By suppressing the increasing middle voltage **E** of the condenser **4** in this manner, the voltage is maintained at a certain value.

Next, when some kind of abnormality occurs to the servomotor **7**, and the excessive current detector **21** detects this excessive current, the protection circuit **20** shuts off the switching of the transistors T_1 - T_6 of the inverter circuit **6**, also shutting off the power supply to the servomotor **10**. At this time, the voltage generated by the servomotor **7**, which is generally below the middle voltage **E**, is not regenerated through the diodes D_1 - D_6. Thus, the servomotor **7** rotates freely without any restriction.

However, the moment when the transistors T_1 - T_6 are shut off, the main switch **1** is turned off by the signal transmitted from the protection device **21**, releasing the connection point **14** (connection point **b**). As a result, the connection point **14** becomes ON. Hence, the charged voltage of the condenser **4** is supplied as the base current of the switching transistor **9** through the resistor **13** and contact point **15**, thereby making the transistor **9** ON. Thus, the charged voltage of the condenser **4** decreases by discharging through the resistor **8** and connection point **9**. Once the charged voltage of the condenser **4** becomes below the voltage generated by the servomotor

7, the voltage generated by the servomotor **7** starts charging the condenser **4** through the diodes D_1 - D_6. As already described, since the charged voltage is discharged through the resistor **8** and transistor **9**, a regenerating action occurs to the servomotor **7** to control its rotation.

As described above, one discharge circuit consisting of the resistor **8** and transistor **9** can suppress the increasing middle voltage and also control the power generation of the servomotor **7** in an abnormal state. Furthermore, since the resistor **13** and contact point **14** used in this operational example are for supplying a base current, their capacity can be small.

Note that this invention can be applied to various motors operated by inverters.

[Effect of this Invention]

As described above, since this invention adds a function of controlling the power generation at the time of abnormal load to the discharge circuit used to suppress an increasing middle voltage, the number of parts having a large transmission capacity can be reduced, thereby allowing the control device to be compact and inexpensive.

4. Simple Explanation of the Figures

Figure 1 is a circuit schematic of the control device used in the first operational example of this invention. Figure 2 is a circuit schematic of the conventional control device.

1...Main switch; 2...Rectifying circuit; 3...Auxiliary switch; 4...Condenser; 5, 8, 13...Resistor; 6...Inverter circuit; 7...Servomotor; 9...Transistor; 10...Discharge control circuit

Figure 1

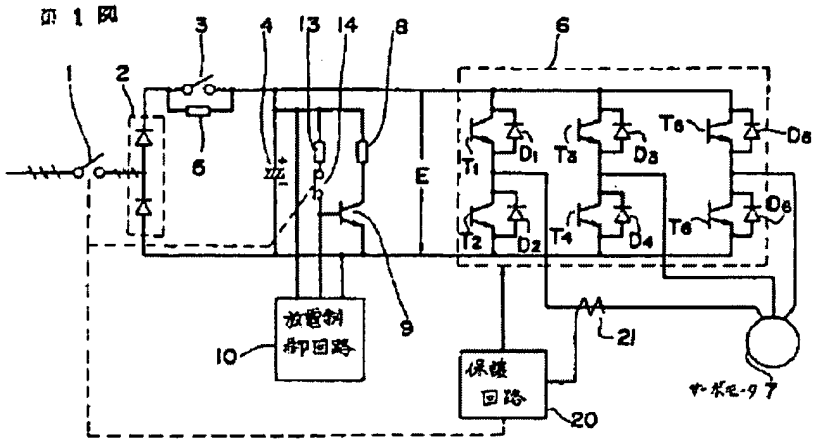

Figure 2